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1 JC06 Rec'd PCT/PTO 08 APR 2005**RACKET SHAFT AND RACKET EQUIPPED WITH SUCH SHAFT****Technical Field of the Invention**

The present invention relates to a racket shaft that at
5 one end is intended to be connected to a racket head, said
racket shaft comprising a grip portion, said racket shaft at
its other end having a knob that is detachably mounted on the
racket shaft, said knob having an across dimension that is
larger than the diameter of the portion of the racket shaft to
10 which the knob is attached. The invention also relates to a
racket equipped with a racket shaft according to the present
invention.

Prior Art

15 From EP 0 898 988 A2 a racket shaft is previously known,
said racket shaft having an exchangeable grip portion that
can be mounted on and demounted from a core of the racket
shaft. In order to anchor the grip portion to the core a
screw is brought to cooperate with a wedge-shaped nut that is
20 locked axially within the core.

From US-A-5,605,327 a racket shaft is previously known,
said racket shaft at its free end having a butt cap that may
be pushed on the free end of the racket shaft. The butt cap
defines an internal cavity in which a ballast, in the shape of
25 metal shot or metal discs, may be provided.

From each one of US-A-259,448 and US-A-4,828,261 a
racket shaft is previously known that is equipped with two
depressions extending around the racket shaft, said
depressions being located at a distance from each other in the
30 longitudinal direction of the shaft. The transitions between
the depressions and the adjoining portions are rounded.

Objects and Features of the Invention

A primary object of the present invention is to present
35 a racket shaft/racket that generally is a ergonomically
designed in order to give the player a better grip, control,
support and balance.

Still an object of the present invention is to make
certain portions of the racket shaft exchangeable.

A further object of the present invention is to provide an improved balancing of the racket shaft.

At least the primary object of the present invention is realised by means of a racket shaft/racket that has been given
5 the features of the appending independent claims.

Brief Description of the Drawings

Below an embodiment of a racket according to the present invention will be described with reference to the accompanying
10 drawings, where:

- Figure 1 shows a top view of a racket according to the present invention;
- Figure 2 shows a detail of the racket shaft of the racket according to figure 1;
- 15 Figure 3 shows a section along III-III in figure 2;
- Figure 4 shows an exploded view of the racket shaft according to figure 2, said shaft being composed of a number of exchangeable parts; and
- Figure 5 shows the parts of figure 4 in assembled condition,
20 where a number of sections are made in order to increase the clarity.

Detailed Description of a Preferred Embodiment of the Present Invention

25 The racket according to the present invention, shown in figure 1, comprises a racket shaft 1 and a racket head 3 that mutually are rigidly connected in such a way that the existing forces may be transferred between the racket head 3 and the racket shaft 1. Generally, the racket shaft 1 according to
30 the present invention has a new and innovative design while the racket head 3 is of a conventional design.

As seen in top view according to figures 1 and 2 the racket shaft 1 has a first thickened portion or a first bulging 5 and a second thickened portion or a second bulging
35 7. Between the first and second bulging 5 and 7 an intermediate portion 9 is provided, a rounded transition being present between the bulgings 5, 7 and the intermediate portion 9.

Both bulgings 5 and 7 have also a rounded wave shape in the longitudinal direction of the racket shaft 1. Both bulgings 5,7 and the intermediate portion 9 are preferably equipped with an external grip wrap that is symbolised by the oblique lines 10 in figures 1 and 2. This coating 10 is exchanged when it has been worn out.

The two bulgings 5, 7 of the shaft 1 bring about an adaption to the anatomic gripping shape of the hand. The hand has a receiving negative (concave) gripping shape. When a hand grips a clod of clay of suitable size and squeezes it until a comfortable gripping thickness has been achieved, the result is an elongated body having a shape that corresponds to the bulgings 5 and 7 of the racket shaft 1. The reason why the shaft 1 is equipped with two bulgings 5, 7 is to make it suitable also for a two hand grip that is practised by many players, preferably in connection with backhanders. The distance between the two bulgings 5, 7, in the longitudinal direction of the racket shaft 1, may of course vary depending on the size of the hands of the player that is gripping the racket shaft 1.

The cross section of the racket shaft 1 according to the present invention is shown in figure 3 and it is evident that a core 12 has a general square shape with bevelled corners. On the exterior of the core 12 a grip portion 13 is provided, said grip portion 13 on its external side having bulgings 5, 7 and the intermediate portion 9. Internally, the grip portion 13 is equipped with a layer 8, preferably of rigid plastic, and the cross section of this layer 8 is adapted to the cross section of the core 12, i.e. the layer 8 defines an internal hole of the grip portion 13. The rest of the grip portion 13, i.e. the portion having the bulgings 5, 7 and the intermediate portion 9, is preferably made out of silicone rubber or foamed rubber. This is of course only an example and the user may of course choose material in the grip portion in order to achieve an optimum of individual adaption.

At the lower end of the shaft 1, see figures 1 and 2, a knob 11 is attached, said knob 11 having a spherical shape in the portion that faces away from the adjacent second bulging 7.

At the end of the racket shaft 1 facing away from the racket head 3 a knob 11 is attached, said knob 11 generally having a maximum across dimension T that is essentially larger than the diameter D of the end of the shaft 1 that the knob 11
5 adjoins to. Preferably, the relationship between T and D is the following $1,5D < T < 2D$.

In figures 3 and 4 a preferred structural design of a racket shaft 1 according to the present invention is shown more in detail. Figure 3 shows the main components
10 constituting the disclosed embodiment of the racket shaft 1 according to the present invention. Thus, the racket shaft 1 comprises a core 12, for instance manufactured from aluminium, plastic, kevlar or graphite. For manufacturing reasons it may be preferable that the core 12 and the racket head 3 are
15 manufactured from the same material. In case the core is manufactured from aluminium it is usually hollow. This core 12 is rigidly connected to the racket head 3 in such a way that existing forces may be transferred between the racket head 3 and the core 12. The racket shaft 1 also comprises a
20 grip portion 13 that in its turn is equipped with the two bulgings 5 and 7 and the intermediate portion 9. Preferably, the core 12 has an external out-of-round cross sectional shape and the grip portion 13 has an internal through going hole 8 having the corresponding out-of-round cross sectional shape.
25 The reason therefore is to avoid that the grip portion 13 rotates relative to the core 12. Preferably, the cross sectional shape is octagonal.

The racket shaft 1 also comprises the knob 11 that is equipped with an externally threaded portion 14 and a
30 detachable cap 15 that is located on a diametrically opposite side of the knob 11 relative to the threaded portion 14. The cap 15 is connected to the rest of the knob 11 by means of a thread coupling, the rest of the knob 11 being hollow, see figure 4.

35 In Fig 4 it is shown how the components according to figure 3 are assembled in order to create a racket shaft 1 according to the present invention. The grip portion 13 is pushed on the core 12 and the knob 11 is mounted on the free end of the core 12. The detachable mounting of the knob 11 is

effected by having the externally threaded portion 14 to cooperate with an internally threaded hole 16 in the core 12. A suitable tightening of the knob 11 effects a proper anchoring of the knob 11 on the free end of the core 12.

5 As is evident from figure 4 the hollow knob 11 is filled with lead pellets 17 that gives the possibility to affect the weight distribution of the racket according to the present invention.

10 By having certain of the components, included in the racket shaft 1, detachably mounted on the core 12 the possibility is offered that components of different sizes, i.e. grip portions 13 and knobs 11, may be mounted on the core 12. As regards different sizes of the grip portion 13 it is basically the question of different maximum diameters of the 15 bulgings 5, 7 and also the mutual distance between the bulgings 5, 7. As regards the knobs 11 different sizes normally means different across dimensions T.

 Especially as regards the grip portion 13 the possibility to detach also means that grip portions 13 20 manufactured from different materials may be used, this further emphasising the possibility to individual adaption. As regards different materials of the grip portion 13 soft silicone-like rubber, more rigid foamed rubber or a combination of different plastics may be mentioned in an 25 exemplifying and non-restricting purpose. It is also possible that the material used for the grip portion 13 is inherently vibration damping or that vibration damping inlays are locally attached between the core 12 and the grip portion 13.

 The grip portion 13 may also have different surface 30 patterns, e.g. grooving, projecting pimples, recessed holes, wave-like embossing. Taken together, proper choice of material and proper surface pattern gives a compact contact with the hand as well as proper absorption of existing sweat. The material and the surface pattern bring about an airiness 35 that enables cooling of the hand and a natural dryout of excessive sweating of the hand.

 In this connection it should be mentioned that in certain circumstances it is possible that the grip wrap 10 on

the grip portion 13 is deleted and it is also possible that the entire grip portion 13 is exchanged when it is worn out.

As is evident from figure 4 both the grip portion 13 and the knob 11 are detachably attached to the core 12. This structural design offers a unique possibility to the individual player to custom-make his/her own racket, i.e. he/she may choose the grip portion 13 that is individually adapted as regards both dimensions, material choice and surface structure. Also regarding the knob 11 the player may choose a suitable dimension and through the hollowness of the knob 11, via the filling degree of lead pellets 17 in the hollow knob 11, affect the weight distribution of the racket according to the present invention.

The knob 11, attached to the free end of the core 12, brings about that the hand is given a distinct support at the free end of the shaft portion 1. This brings about a natural prevention against dropping the racket, i.e. it is in principle not possible for the racket to slide out of the hand. Besides the knob 11 increases the contact surface between the shaft portion 1 and the hand of the player.

The knob 11 also brings about other functional benefits when using the racket according to the present invention. In tennis it is a distinct benefit for the player to have a large reach in his/her motions and to have a high point of impact relative to the court of the opponent. This is especially important in connection with the serve. Thereby, the knob 11 somewhat increases the length of the racket shaft 1, compared to a conventional racket shaft, since the grip fully or partly may be located to the knob 11. This is of especial importance in connection with the serve and when returning balls close to the sidelines.

When the player fully or partly has his/her grip on the knob 11 the hand and the wrist may more easily rotate relative to the racket shaft 1, this being an obvious benefit when the player wishes to hit balls with a distinct top spin. In connection with the serve a harder, more flat serve is achieved, compared to a traditional grip, since the hand partly rotates relative to the knob 11 during the final phase of the serve.

Feasible Modifications of the Invention

In the embodiment described above it has been stated that the internal through going hole of the grip portion 13 and the core 12 have cross sections corresponding to each other. However, within the scope of the present invention it is also feasible that the grip portion 13 is designed from such a flexible material that the internal through going hole of the grip portion 13 adapts to the external shape of the core 12 when the grip portion 13 is mounted on the core 12, this preferably being done by pushing the grip portion 13 on the core 12. Also in this case it is avoided that the grip portion 13 rotates relative to the core 12.

In the embodiment described above the racket shaft 1 comprises a number of exchangeable components. However, within the scope of the present invention it is feasible that the racket shaft is not equipped with exchangeable components but the components of the racket shaft being permanently connected to each other.

The invention is primarily initiated for tennis rackets. However, the principles of the present invention may also be applied in connection with rackets for other sports and in exemplifying end non-restricting purpose squash and badminton may be mentioned. Of course, there will normally be a certain adaption to the sport in question when producing a racket /a racket shaft according to the present invention.